Trang: Wray, No. 3185. Perak: King's Collector, No. 6726.

A species of which the nearest ally is *C. Hookeri*, King, which has however much narrower leaves not tesselate on the lower surface. This is also allied to the Bornean species *C. Beccariana*, Stapf, which has however much smaller leaves, not tesselate beneath.

Natural History Notes from H. M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R. N., commanding.—Series II., No. 24. *Report on the Paguridæ collected during the season* 1893-94.—*By* J. R. Henderson, M.B., F.L.S., *Fellow of the University of Madras, Professor of Biology in the Madras Christian College.**

[Recd. 23rd June—Read 1st July.]

The *Paguridæ* collected by the "Investigator" during the season 1893-94, form a small but interesting collection of seventeen species, for the opportunity of examining which I am indebted to my friend Surgeon-Captain A. R. Anderson, I. M. S., the Surgeon-Naturalist of the "Investigator." The small number of species is doubtless to be explained by the fact that no special attention could be paid to shallow-water forms; had time and opportunity permitted, the number of these might have been very largely increased. Of the seventeen species taken, two have been left unnamed, as the specimens by which they are represented are either very young or are in an imperfect state of preservation. The collection also contains an undescribed *Glaucothoë* which appears to be a larval form, and I have therefore not given it a specific name. Of the fourteen named species no less than seven are described as new, and the remaining seven—six of which are from shallow water—belong to previously known species. The large proportion of new species is not remarkable when the deep-water habitat of the majority is taken into consideration. The fourteen species are included in no fewer than ten genera.

The specimens were taken at six dredging stations, at five of which the depth exceeded 100 fathoms, so that the collection may fairly be described as a deep-water one. The greatest depth at which Pagurids were taken during the trip was 719 fathoms, off the North Maldive Atoll, where two new species of the characteristic deep-water genus *Parapagurus* were obtained. The last dredging station on the list is a shallow-water one off the east coast of Ceylon, where from 28 fathoms six species were obtained, three of which are new. There are

* Communicated by the Natural History Secretary.

also included in the collection three shore species, from the Laccadives, Trincomalee Harbour, and Pulicat on the Madras coast.

Four species belong to deep-water genera, *viz.*, two (new) to *Parapagurus*, one to *Sympagurus* (which is very closely allied to if not identical with *Parapagurus*), and the fourth (new) apparently to *Pylopagurus*. The two last named genera are new to Indian seas. The genus *Pylopagurus* was recently established by MM. A. Milne-Edwards and Bouvier, to include several species taken by the "Blake" in the West Indian region, and a single species described by Studer (as an *Eupagurus*) from the South African coast. The four remaining new species belong to the following genera :—two to *Paguristes* (including one from deep-water), one to *Eupagurus*, and one to the interesting genus *Catapagurus*.

Of the previously known shallow-water species four belong to well known and for the most part widely distributed species, *viz.*, the two species of *Calcinus*, *Spiropagurus spiriger* (De Haan), and *Clibanarius padavensis*, de Man. The remaining two are now recorded for the first time since their diagnoses were published by the present writer some years ago. *Pagurus dearmatus* was originally taken at the Admiralty Islands, and *Eupagurus zebra* on the north-west coast of Australia, as well as on the Ceylon coast.

The majority of the species are represented each by a small number of specimens, but two—*Paguristes puniceus* and *Sympagurus monstrosus*—were taken in large numbers.

List of dredging stations with the species taken at each.

Station 150, off the north Maldive Atoll. Lat. 7° 05′45″ N. Long. 75° 04′ 0″ E. Depth 719 fathoms. Bottom fine coral sand.

Parapagurus andersoni, n. sp.
„ *minutus*, n. sp.
Glaucothoë.

Station 151, Colombo Light House S. 64 E. 13½ miles distant. Depth 142 to 400 fathoms. Bottom brown mud.

Sympagurus monstrosus (Alcock).
Eupagurus, sp.

Station 162, off the Madras coast. Lat. 13° 51′ 12″ N. Long. 80° 28′ 12″ E. Depth 145 to 250 fathoms. Bottom brown mud.

Paguristes puniceus, n. sp.
Sympagurus monstrosus (Alcock).

Station 166, off the Madras coast. Lat. 13° 34′ 55″ N. Long. 80° 32′ 12″ E. Depth 133 fathoms. Bottom brown mud.

Paguristes puniceus, n. sp.
Pylopagurus magnimanus, n. sp.

Station 170, off the Madras coast. Lat. 13° 01′ 06″ N. Long. 80° 36′ 56″ E. Depth 107 fathoms. Bottom sand and soft brown mud with cinders (steamer route).

Pylopagurus magnimanus, n. sp.

Station 175, off the east coast of Ceylon. Lat. 8° 51′ 30″ N. Long. 81° 11′ 52″ E. Depth 28 fathoms. Bottom sand, shells, and stones.

Pagurus dearmatus, Henderson.
Eupagurus zebra, Henderson.
Spiropagurus spiriger (De Haan).
Eupagurus pergranulatus, n. sp.
Catapagurus muricatus, n. sp.
Paguristes pusillus, n. sp.

Shore species.

Calcinus herbsti, de Man. Laccadives. Trincomalee.
„ *elegans* (Milne Edwards), Laccadives.
Clibanarius padavensis, de Man, Pulicat.
„ sp. indet. Trincomalee.

Report on the species.

Genus Pagurus, Fabricius.

1. *Pagurus dearmatus*, Henderson.

P. dearmatus, Henderson, "Challenger" Anomura, p. 58, pl. vi. fig. 5 (1888).

Station 175, off the east coast of Ceylon, depth 28 fathoms. A male about 18 mm. long.

This species was founded on a single specimen—a female with ova, measuring 24 mm. in length—taken by the "Challenger" at the Admiralty Islands, from a depth of 16 to 25 fathoms. It is allied to *P. pedunculatus*, Herbst (with which *P. varipes*, Heller, is perhaps identical) and *P. deformis* Milne Edwards, but is distinguished from both by the uniform granulation of the outer surface of its larger hand as well as by the smaller size of the species in general.

The "Investigator" specimen agrees closely with the original description, except that the propodus of the third left leg is faintly carinated externally, a character not mentioned in the "Challenger" Report. A red band encircling each eye-stalk about its middle, is still visible.

Genus Calcinus, Dana.

2. *Calcinus herbsti*, de Man.

Pagurus tibicen, Milne Edwards Ann. Sci. Nat. (2) t. VI. p. 278 (1836); Hist. Nat. Crust. t. II. p. 229 (1837).

Calcinus tibicen, Dana, Crust. U. S. Explor. Exped. pt. i. p. 457 (1852).

Calcinus herbsti, de Man, Arch. f. Naturg. Jahrg. 53, Bd. i. p. 437 (1887) Ortmann, Zoolog. Jahrbücher, Bd. VI. Abth. f. Syst. p. 292 (1892) *ubi synon.*

Suhelipar, Laccadives: a male about 25 mm. in total length.

Great Sober Island, Trincomalee Harbour; a female about 20 mm. long.

The chelipeds are dark brown in colour, with the exception of the fingers and outer surface of the palm in the left or larger chela, and the finger-tips of the right chela, all of which are white. The second and third pair of walking-legs are orange with white dactyli, the latter having each a small orange band near the tip; there is also a faint red longitudinal band on the outer or posterior surface of the meral and carpal joints. The eye-stalks are orange with a broad white basal band.

The species is common and widely spread over the coral region of the Indo-Pacific area, from Natal and East Africa, to the Sandwich Islands, and the islands of the Pacific generally. It is recorded from the Maldives by Ortmann.

3. *Calcinus elegans* (Milne Edwards).

Pagurus elegans, Milne Edwards, Ann. Sci. Nat. (2) t. vi. p. 278 (1836); Hist. Nat. Crust. t. ii, p. 229, pl. xiii. fig. 2 (1837).

Calcinus elegans, Dana, Crust. U. S. Explor. Exped. pt. i. p. 458, pl. xxviii. fig. 10 (1852); Ortmann. Zoolog. Jahrbücher, Bd. vi. Abth. f. Syst. p. 294 (1892) *ubi synon.*

Suhelipar, Laccadives; two males.

The larger specimen which measures about 40 mm. in length, has the left or larger chela dark olive-green in colour. The second and third pairs of ambulatory legs are blue, with purple-black bands on the meral, carpal, and propodal joints, while the dactyli are similarly spotted. The eye-stalks are blue, the antennal peduncles and flagella orange.

The second specimen measuring about 33 mm. in length, has the left chela orange brown. The ambulatory legs are white with crimson bands, and similar spots on the dactyli. The eye-stalks are white with a bluish tinge, the antennae orange. According to Dana the colouring is as follows:—"Hands bright green except white tubercles, antennae orange, eyes blue. Second and third pairs of legs banded with velvet black and bright blue, hairs of tarsus carmine." The colour differences in the two specimens may be partly due to greater fading in the second, but not entirely so. There is evidently considerable colour variation.

This species like the last, extends from Natal and East Africa to the Pacific, but is evidently less common than *C. herbsti*.

Genus Clibanarius, Dana.

4. *Clibanarius padavensis*, de Man.

C. padavensis de Man, Mergui Crust. p. 242, pl. xvi. figs. 1-5 (1888); Henderson, Trans. Linn. Soc. 2 ser. Zool. Vol. V. pt. 10, p. 423 (1893).

Pulicat, Madras Coast; a large series.

The largest specimen is an adult male measuring 70 mm. in length. Young individuals are found in the shells of a *Cerithium*, older ones in the shells of *Ranella*, *Eburna*, etc., and on one of the shells there is an encrusting hydroid.

The second and third pairs of ambulatory legs exhibit a well-marked longitudinal blue band, best seen on the posterior surface of the propodi. This blue band is bordered both above and below, by a dark brownish or reddish band.

The species was first recorded by de Man from Mergui, and as I have elsewhere shown, is common in the brackish back-waters, along the Madras Coast, as far south as Tuticorin.

Genus Eupagurus, Brandt.

5. *Eupagurus zebra*, Henderson.

E. zebra, Henderson, Trans. Linn. Soc. 2 ser. Zool. Vol. V. pt. 10, p. 425, pl. xxxix. figs. 12–15 (1893).

Station 175, off the east coast of Ceylon, depth 28 fathoms. Two specimens in the shells of a *Murex*.

The smaller specimen is a female with ova about 15 mm. long the other a male about 20 mm. in length.

The species was founded on two specimens, one from the Ceylon coast, the other taken at a depth of 53 fathoms, off the north-west coast of Australia. The latter, which was the larger of the two, measured 21 mm. in length. It is easily distinguished by its colour markings, which take the form of dark red lines on the ambulatory legs, chelipeds, carapace, and even on the antennal peduncles and flagella. From evidence supplied by one of the original specimens, there is reason to believe that this hermit-crab like the mollusc *Avicula zebra*, Reeve, lives among hydroids, and the linear colour markings by their resemblance to the ramuli of the hydroid, serve a protective function.

6. **Eupagurus pergranulatus*, n. sp.

Station 175, off the east coast of Ceylon, depth 28 fathoms. An adult female.

The anterior portion of the carapace is membranous, with the median frontal projection slightly marked, and exceeded by the slightly

* Ill. Zool. Investigator, Crustacea, pl. xxxi. fig. 1 (*in preparation*).

better marked lateral projections. The eye-stalks are very large, and slightly curved, with large deeply pigmented corneæ; they are about one-fourth of their length longer than the antennal peduncles, and about equal in length to the antennular peduncles, when the latter are fully extended. The ophthalmic scales have narrow subacute apices, and are separated by a wide interval. The antennal acicle has a slight sigmoid curve, and extends almost to the end of the antennal peduncle; the antennal flagellum appears to be about two-thirds the length of the body.

The right or larger chelipede is massive and slightly pubescent. The merus is provided with a series of short acute spines on either side of the under surface, but is otherwise smooth. As all the joints move in a vertical plane, the under surface of the merus is excavated anteriorly to receive the carpus, and the above mentioned spines are placed on the margin of this depression. The upper surface of the carpus is armed with short scattered spinules, which are most prominent on the inner margin, while the lower surface is reduced to a narrow transverse area. The upper surface of the hand is granulated, the granules especially those on the immobile finger, being crescentic in outline, and all of them are smooth and glabrous. Each granule has an anterior depression or concavity, which gives it the characteristic crescentic form, but some few of the granules are circular with a central depression. On the inner margin of the hand, which terminates in a well-marked subacute lobe, projecting over the insertion of the mobile finger, the granules are replaced by short denticles. On the outer margin of the hand there is a very regular row of granules, which appear square-topped when viewed from the side. The mobile finger is massive, with a faint median carina on its upper surface, and crescentic granules similar to those of the hand. The apices of the fingers are calcareous.

The left or smaller chelipede has a few spinules on the lower surface of the merus, and on the upper surface of the carpus; in the latter situation they are arranged in two rows. The carpus is as long as the hand. The hand has a slight dorsal carina, and its upper surface is provided with crescentic granules; the apices of the fingers are corneous.

The ambulatory legs are faintly pubescent, with the dactyli ending in acute horny tips.

The margin of the telson is fringed with short acute spinules.

The single specimen gives the following measurements:—

Length of body about	... ...	16 mm.
„ „ carapace	... ...	8 „
„ „ right chelipede (which cannot be fully extended) about	... ...	15 „

Length of carpus of right chelipede ... ... 4·5 mm.
„ „ hand of right chelipede ... ... 7 „
„ „ eye-stalk ... ... 4 „

Although there is only a single specimen, I have ventured to describe this species on account of its well marked characters, more especially the peculiar type of granulation met with on its chelipedes, which distinguishes it from all other members of the genus with which I am acquainted.

Genus PYLOPAGURUS, A. Milne-Edwards and Bouvier.

"Blake" Paguridæ, Mem. Mus. Comp. Zool. (Harvard Coll.) Vol. XIV. No. 3. p. 74 (1893).

I refer the species described below with some hesitation to this genus, as it does not possess the characteristic lid-like right chela, used as a kind of operculum to close the shell, which is one of the special features of *Pylopagurus*. The hand is not ovate in form, and it can be fully extended, yet at the same time it is capable of being bent at a right angle to the carpus, a character mentioned by Milne-Edwards and Bouvier. It has the general appearance of an *Eupagurus*, and I would have referred it to that genus but for the arrangement of the abdominal sexual appendages, which present the very unusual characters described for *Pylopagurus*. There is a single pair of minute appendages in the female immediately behind the last thoracic sternum, while corresponding paired appendages are entirely absent from the male.

7. **Pylopagurus magnimanus*, n. sp.

Station 166, off the Madras Coast, depth 133 fathoms. A female (damaged) in a *Rostellaria* shell.

Station 169, off the Madras Coast, depth 107 fathoms. A male in perfect condition, but without a shell.

The anterior portion of the carapace is slightly calcified, and practically eight-sided in outline; it is separated from the surrounding regions by deep grooves. The median frontal projection is well-marked, with a broad base and a sub-acute apex; the lateral frontal projections are fairly well-marked, and some distance behind each there is a pit on the dorsal surface of the carapace. The eye-stalks are moderately slender, and faintly compressed from above downwards; the corneæ are rather pale in colour. The ophthalmic scales are well-developed, entire, and acute, the apical half of each scale being slightly depressed. The antennal peduncles exceed the eye-stalks by about one-half the length of their terminal joint; the acicle is strongly curved, with a fringe of hairs on its inner margin. The external prolongation of the

* Ill. Zool. Investigator, Crustacea, pl. xxxi. fig. 2 (*in preparation*).

second joint of the antennal peduncle extends slightly beyond the middle of the penultimate peduncular joint, and its apex carries a series of hairs. The antennal flagella are about one and a half times the length of the body. The antennular peduncles exceed the eye-stalks, by about three quarters of the length of their last (peduncular) joint.

The right chelipede is massive, and its form recalls that of *Eupagurus zebra*, Henderson; the joints are granulated, and the granules exhibit a tendency to become sub-spinose. The merus has a prominent serrated lobe on its inner and lower margin; on the under surface of the joint there is a low regularly granulated pyramidal elevation. The lower and inner margin of the carpus presents a similar but smaller serrated lobe, while the upper surface of this joint is armed with sub-spiniform granules. On the inner margin of the carpus these granules are replaced by short conical spines, arranged in several longitudinal rows, and along the distal margin of the joint, adjoining the carpo-propodal articulation, there are about six of these spines, somewhat larger than the others, arranged in a row, behind which a narrow smooth area is visible. The upper surface of the propodus is rather uniformly granulated, but the granules have a tendency to become spiniform along the inner margin of the joint, near its proximal end; the outer margin is thin and regularly curved or deflexed towards the apex of the immobile finger. The upper surface of the dactylus is uniformly granulated; its inner margin is thin, and there is a longitudinal concave area on the under surface.

The left chelipede when stretched, extends almost to the insertion of the dactylus in the larger chelipede. It is moderately pubescent, and a row of spinules is found on the lower margin of the merus, and another on the upper margin of the carpus. The latter joint is only slightly shorter than the combined hand and fingers.

The ambulatory legs are slightly pubescent, and almost unarmed, only one or two minute spinules being visible on the carpal joints, in the male specimen. The dactyli have yellow horny apices. The sexual appendages on the first abdominal segment of the female are minute, but the three biramous appendages on the left side are well developed.

The gill lamellæ, which are arranged in two rows, are long and narrow.

The male specimen gives the following measurements:—

Length of body	...	38 mm.
„ „ carapace	...	16·5 „
„ „ right chelipede	...	37 „
„ „ carpus of same	...	8·5 „

Length of propodus	...	...	...	15	mm.
Greatest breadth of propodus	...	...	...	11·5	„
Length of second right leg	...	...	...	47	„
„ „ propodus of same	...	...	...	9	„
„ „ dactylus „ „	...	...	...	15	„

The female is slightly smaller.

There is a note by Surgeon-Captain Anderson, as to the colour of the species during life, preserved in the bottle which contains the broken specimen. "Legs crimson dotted with yellowish white, under surface of the joints white. Carapace brownish pink. Lived in the accompanying *Rostellaria*."

The species differs from all others so far allotted to its genus, in the form of its non-operculiform hand.

Genus Spiropagurus, Stimpson.

8. *Spiropagurus spiriger* (De Haan).

Pagurus spiriger, De Haan, Crust. Japon. p. 206, tab. xlix. fig. 2 (1850).

Spiropagurus spiriger, Stimpson, Proc. Acad. Nat. Sci. Philad. p. 248 (1858); Henderson, "Challenger" Anomura, p. 72 (1888); Ortmann, Zoolog. Jahrbücher, Bd. VI. Abth. f. Syst. p. 297 (1892).

Station 175, off the east coast of Ceylon, depth 28 fathoms. Two males.

The larger specimen is about 30 mm. long and inhabited the shell of a *Harpa*. Its extended or unrolled copulatory organ measures 20 mm. in length. The species is devoid of any bright colouration and a special feature is the large size of its eyes. The dactyli and propodi of the ambulatory (or probably swimming) legs, are closely fringed with hairs. All the specimens I have met with at Madras—where the species is common—occurred in light shells, such as could be easily carried by a swimming animal. A similar selection of the shell in order probably to suit the habits of the inmate, is seen in the genus *Clibanarius*, the members of which on the Madras coast at least, almost invariably select heavy shells, and are generally found in exposed and often surfbeaten situations.

The present species has been recorded from the seas of Japan, China, Admiralty Is., Torres Strait, Malay Archipelago, and the Bay of Bengal (Madras and Gulf of Martaban). It is a shallow-water form.

Genus Catapagurus, A. Milne-Edwards.

9. **Catapagurus muricatus*, n. sp.

Station 175, off the east coast of Ceylon, depth 28 fathoms. Three males, and two females with ova.

* Ill. Zool. Investigator, Crustacea, pl. xxxi. fig. 3 (*in preparation*).

The anterior portion of the carapace is smooth, with the median or rostral projection scarcely marked. The eye-stalks extend almost to the end of the antennal peduncle, but scarcely to the middle of the terminal joint of the antennular peduncle; the corneæ are somewhat dilated. The inner distal end of each ophthalmic scale is produced into a small conical projection, from the under surface of which, near its apex, a small spinule arises. The antennal acicle is slender and strongly curved, reaching to about the middle of the terminal joint of the antennal peduncle; the antennal flagellum is naked.

The right chelipede is only slightly longer and stouter than the left; both are pubescent and strongly spinose, especially on the hands and fingers, the arrangement being similar in the two chelipedes. The carpus is slightly longer than the hand (*i.e.*, the propodus *minus* the immobile finger), and it carries an inner row of curved acute spinules on its upper surface, and an outer row of smaller and blunter spinules. The upper surface of the hand is armed with three longitudinal rows of short and curved, but somewhat blunt, spines; the two marginal rows extend to the apices of the dactylus and immobile finger respectively, and are slightly more prominent than the median row, which extends along the upper surface of the immobile finger. There are in addition numerous smaller spines, scattered irregularly between those of the longitudinal rows. The opposing edges of the fingers are rather strongly toothed, and towards its apex the dactylus is corneous and slightly excavated. The fingers of the left chelipede are about equal in length to the palm, whereas those of the right chelipede are slightly shorter.

The ambulatory legs are faintly pubescent, but unarmed. Their dactyli are slightly longer than the propodi, and terminate in acute horny apices.

The male copulatory organ (protruded vas deferens) is very slender; it springs from the coxal joint of the last right leg, and in one specimen is rolled into a spiral of at least two turns. It becomes readily uncoiled when the specimen is handled.

The total length of a male is about 15 mm., while females with ova are even smaller. Detached chelipedes probably from the same specimen measure as follows:—

Length of right chelipede	...	...	...	14 mm.
„ „ left chelipede	...	...	...	13 „

One specimen has a small Bopyrid in its branchial chamber.

This species is distinguished at once from the only other known Indo-Pacific species, viz., *C. australis* Henderson, taken by the "Challenger," at Fiji, and in the Arafura Sea, and *C. ensifer*, Henderson, from the Gulf of Martaban, by the armature of its subequal chelipedes.

Moreover in the latter species the dactyli resemble sword-blades, and are perhaps used for swimming. The American species described by A. Milne-Edwards, and S. I. Smith, come from deep water, and have the sexual organ shorter, stouter, and simply bent round the abdomen, whereas in the species just described, and probably in the two other Indo-Pacific forms, the organ is much longer, more slender, and capable of being coiled after the fashion of *Spiropagurus*. These differences are not in my opinion sufficiently important to separate the eastern and western species generically.

Genus Paguristes, Dana.

10. **Paguristes pusillus*, n. sp.

Station 175, off the east coast of Ceylon, depth 28 fathoms. Three males, and two females with ova.

The median frontal projection is prominent, extending well between the ophthalmic scales, and is at the same time subacute and deflexed; the lateral frontal projections are also subacute. The eye-stalks are long, exceeding the antennal peduncles by about half their length, and even slightly exceeding the antennular peduncles. The ophthalmic scales have their apices in some cases minutely bidentate, or even tridentate, in other cases they are apparently entire. The antennal acicle scarcely reaches the end of the ultimate peduncular joint, and exhibits three well marked spinules on its outer margin; the external prolongation of the second joint is apparently bispinose. The antennal flagellum is extremely short, being only slightly longer than the eye-stalk; it is only sparingly ciliated.

The chelipedes are subequal, or the left is very slightly larger; they are without prominent hairs anywhere, and the upper surface of the carpus, propodus, and dactylus, is uniformly provided with subspiniform granules. These granules become distinctly spinose on the inner margin of the carpus and propodus, especially on the former joint, which is longer than the hand. A few spinules are also met with at the distal end of the merus, both on its upper and its lower margin. The fingers are in contact throughout their length, and are without prominent teeth.

The ambulatory legs are of moderate length; the first pair with their carpal and propodal joints spinulose anteriorly, the dactylus less distinctly so; the second pair are almost devoid of spinules. Both pairs are faintly pubescent. The propodi of both pairs are slightly shorter than the dactyli.

The following colour markings are still visible. The eye-stalks, antennal, and antennular peduncles, are purplish. The meral joints

* Ill. Zool. Investigator, Crustacea, pl. xxxi. fig. 4 *(in preparation)*.

of the chelipedes exhibit a single pale blue spot on the outer surface, and two similar spots on the inner surface—all three near the distal end of the joint. The ambulatory legs are faintly banded with red.

The eggs carried by the females are of large size for such a small species, and are concealed in the ovigerous sac. They are even larger than in the next species—*Paguristes puniceus*—in which moreover, they are freely exposed on the side of the abdomen.

An adult male gives the following measurements:—

Length of body	... ...	16 mm.
„ „ carapace	... ...	7 „
„ „ eye-stalk	... ...	4·5 „
„ „ chelipede	... ...	9 „
„ „ first leg	... ...	15 „
„ „ second leg	... ...	16 „
„ „ dactylus of second leg	... ...	4·5 „
„ „ propodus of same	... ...	4 „

The species is characterised by its small size, the nature of its chelipedes, colour markings, etc. In its very short antennal flagella it agrees with *P. hians*, Henderson, from the Philippines, but the two are very different in other respects.

11. **Paguristes puniceus*, n. sp.

Station 162, off the Madras coast, depth 145 to 250 fathoms. A large series chiefly inhabiting the shells of a *Rostellaria*, many of which have an investing *Epizoanthus*. Several of the females are with ova.

Station 166, off the Madras coast, depth 133 fathoms. An adult male in the shell of a *Rostellaria*.

The median frontal projection is less prominent than usual in the genus, and varies considerably in length in different individuals; in some specimens the apex is subobtuse, and scarcely reaches the base of the ophthalmic scales, whereas in others it is acute, and extends almost to the middle of the scales. The lateral frontal projections are almost as prominent as the median one. The anterior surface of the carapace is somewhat rugose, with a few scattered hairs, and there is a marginal sulcus following the contour of the anterior margin. On the posterior membranous region of the carapace, the median or cardiac area is reduced to a linear elevation, bounded by a sulcus on either side, and the two branchial areas thus almost meet in the middle line. This cardiac elevation widens out slightly in front immediately behind the cervical groove. The eye-stalks are shorter than usual in the genus, just reaching the end of the antennal peduncle, or even in some cases slightly falling short of this, and extending to about the

* Ill. Zool. Investigator, Crustacea, pl. xxxii. fig. 1 *(in preparation)*.

middle of the last joint of the antennular peduncle. The ophthalmic scales are rather small, and separated by a considerable interval, with their apices acute and entire. The antennal acicle extends to about the middle of the terminal joint of the antennal peduncle; it is straight and acute, with a few short spines on its inner margin, and sometimes also on its outer margin, concealed by the hairs with which the acicle is clothed. The external prolongation of the second joint of the antennal peduncle is bispinose in some specimens at least; the third joint is produced inferiorly into a strong spine. The antennal flagellum is of moderate length, extending to the tips of the chelipedes, and is fringed with long hairs.

The chelipedes as well as the ambulatory legs are clothed with long silky hairs. The chelipedes are subequal in most specimens, but in some males the right is larger. The carpus, propodus, and dactylus are armed with short acute spines, some of which are horny tipped, and the majority give rise to bunches of silky hairs. On the upper surface of the carpus there is a median longitudinal smooth area, with rows of spinules on either side. The spines are arranged irregularly on the upper surface of the hand and fingers, but there are always three or four more prominent than the others on the inner margin of the hand. The apices of the fingers are horny.

The ambulatory legs are long and slender, especially the second pair; all the joints are provided with long marginal hairs. In some specimens a few spinules are met with on the anterior margin of the carpal and propodal joints, and in older specimens they appear to be represented by slight tubercular elevations. The dactyli are about one and a half times the length of the propodi.

In a note accompanying the specimen from Station 166, the colour during life, according to Surgeon-Captain Anderson, was as follows:—"Legs and anterior part of carapace light pink. Eye-stalks rather darker pink."

The following are the measurements of an adult male:—

Length of body	... ...	35 mm.
„ „ carapace	... ...	17 „
„ „ eye-stalk	... ...	5·5 „
„ „ chelipede	... ...	25 „
„ „ first leg	... ...	40 „
„ „ second leg	... ...	38 „
„ „ dactylus of second leg	... ...	12·5 „
„ „ propodus of same	... ...	7·5 „

Some of the specimens are infested by two different Bopyrid parasites—one living in the branchial cavity, the other attached to the abdomen—but occurring in different hosts.

The species is chiefly characterised by the shortness of its eye-stalks, and the great reduction of the cardiac area of the carapace. It is apparently allied to *P. setosus*, a species from New Guinea, insufficiently described by H. Milne-Edwards, but if Ortmann (Zoolog. Jahrb., Bd. vi., Abth. f. Syst., p. 281, taf. xii., fig. 9, 1892) is correct in his identification of the latter, the two are distinct. The species figured by Ortmann has slightly longer eye-stalks, a longer antennal acicle, and an entirely different configuration of the cardiac area of the carapace; in his description there is but slight reference to the other characters. According to Milne-Edwards the colour of his species was reddish yellow.

Genus Parapagurus, S. I. Smith.

12. **Parapagurus andersoni*, n. sp.

Station 150, off the north Maldive Atoll, depth 719 fathoms. An adult male in a shell of *Bathybembix woodmasoni*, E. A. Smith, invested by an anemone.

The anterior portion of the carapace is moderately convex, both from side to side, and from before backwards; the surface is slightly uneven, with a few tufts of hair near the lateral and anterior margins. The median frontal projection is fairly prominent, while the lateral projections are scarcely indicated at all. The portion of the carapace behind the cervical grooves is membranous, and even the cardiac area is uncalcified. The eye-stalks are slightly concave on their inner surface, and a few rather long hairs are found on the upper surface of each; the corneæ are small, but deeply pigmented. The ophthalmic scales are small and laterally compressed, each terminating in four small apical denticles. The antennal peduncles are broad, and exceed the eye-stalks by about the length of the last peduncular joint; the acicle has a slight sigmoid curve, and extends to the end of the peduncle, while its inner margin is provided with a row of spinules. The external prolongation of the second joint of the antennal peduncle is acute, but very short; the terminal joint of the peduncle is broad, and flattened from above downwards. The antennal flagellum is more than twice the length of the body. The antennular peduncles exceed the eye-stalks by the whole of their terminal joint, and about two-thirds of the length of their penultimate joint.

The chelipedes are elongated and slender, with the joints faintly pubescent, and armed with subspiniform granules. The carpus is about one-fourth of its length longer than the merus; it is practically cylindrical, and the whole surface is uniformly granulated, but the granules or spinules as they might almost be termed, are most marked on the

* Ill. Zool. Investigator, Crustacea, pl. xxxii. fig. 2 *(in preparation)*.

upper surface. The propodus is slightly flattened when compared with the carpus, though both its surfaces are really somewhat convex; the granules are practically confined to its inner and outer margins, where they have assumed a distinct spinose character; they are strongly marked also on the corresponding margins of the fingers. The upper surface of the hand is pubescent, but otherwise almost smooth. The left chelipede extends to a point opposite the middle of the carpus of the larger chelipede. It is everywhere clothed with rather long hairs, and the upper margin of the carpus is carinated.

The ambulatory legs are very long and slender, even exceeding the chelipedes, and they are everywhere glabrous. The anterior margin of all the joints, but especially the meri, carries a few setose hairs, and there is a small spinule at the anterior distal end of the carpi. The dactyli are slightly bent, and flattened towards their apices; their apical portions carry long setose hairs.

The single specimen measures as follows :—

Length of carapace	12	mm.
„ „ right chelipede	52	„
„ „ left chelipede	27	„
„ „ merus of right chelipede	12	„
„ „ carpus of same	15	„
„ „ propodus of same	20	„
„ „ dactylus of same	8	„
„ „ second right leg	57	„
„ „ propodus of same	12	„
„ „ dactylus of same	20	„

The gill-filaments are somewhat flattened, and arranged, as usual in the genus, in four rows; the filaments of each outer row are about two-thirds the length of, and at the same time somewhat narrower than, those of the inner row.

The present species, which I have pleasure in associating with the name of Surgeon-Captain A. R. S. Anderson, is in some respects similar to *P. pilosimanus*,* S. I. Smith, but is more slender, and distinguished at once by the different nature of its ophthalmic scales. In the latter respect it is more like *P. affinis*, Henderson, but this latter is a much stouter species, and differs from the one just described in many respects.

* According to MM. A. Milne-Edwards and Bouvier, the *Parapagurus abyssorum* of my Report on the "Challenger" Anomura, is identical with *P. pilosimanus*. At the time the Report was written I had compared the "Challenger" specimens with those taken by the "Talisman," to which A. Milne-Edwards had given the name of *Pagurus abyssorum*, and finding them identical, described the species under the latter specific name. The *Eupagurus jacobii*, A. Milne-Edwards, is also identical with *P. pilosimanus*.

From the same locality—station 150—there are two small individuals (male and female), which I consider as undeveloped individuals of *P. andersoni*; one is in a similar shell to that which holds the adult type, with an investing anemone, while the other is in a *Natica*. In the larger specimen the carapace measures only 7 mm. in length. Both exhibit much less relative elongation of the chelipedes and ambulatory legs, rendering it probable that elongation is a special character of adult males. The joints of the right chelipede are more definitely subspinose, especially the under surface of the merus and the edges of the hand and fingers, but the subspiniform granulation can of course only be made out with a lens. The hand is broader than in the adult, and more ovate in shape. In one specimen only two denticles can be made out at the apices of the ophthalmic scales, but in the other specimen there are three denticles.

13. **Parapagurus minutus*, n. sp.

Station 150, off the north Maldive Atoll, depth 719 fathoms. Nine specimens—all living in *Dentalium* shells—including two females with ova. The shell tenanted by the largest example is covered by a colony of *Epizoanthus*, composed of four polyps.

In this minute species, which appears to be fully adult, as shown by the presence of eggs, the largest example has the carapace, chelipedes, and legs glabrous with a white porcellanous aspect. In the smaller specimens there is a slight pubescence on all the above named parts, including the eye-stalks, where the hairs may be rather long. Hairs are met with in this last situation even in the largest specimen.

The anterior portion of the carapace is glabrous and regularly convex, with the exception of a slight wrinkling antero-laterally. The median frontal projection is scarcely indicated. The eye-stalks exhibit considerable basal dilatation, and the narrowed apex carries a reduced but deeply pigmented cornea. The ophthalmic scales are minute, and terminate in a subacute point. The antennal peduncles slightly exceed the eye-stalks; the acicle is almost straight, ciliated, and faintly spinose on its inner margin; the external prolongation of the second joint exhibits considerable depth, and its apex can scarcely be termed acute. The antennular peduncles exceed the eye-stalks by more than the length of the last peduncular joint—this however is almost a generic character. The antennal flagellum is apparently not longer than the body, if as long.

The right chelipede has the joints of a white porcellanous aspect. The hand (omitting the fingers) is slightly longer than the carpus, but the proportion seems to vary slightly in different specimens.

* Ill. Zool. Investigator, Crustacea, pl. xxxii. fig. 3 *(in preparation)*.

The length of the hand is not quite twice its breadth. In the largest specimen the joints of the chelipede are almost smooth, there being only a faint denticulation, or almost granulation, visible on the margins of the hand and fingers, but in other specimens there is a regular minute serration, and in these cases the margins are thinner or less rounded. In some cases minute granules are visible on the under surface of the hand and wrist. In one or two examples the tip of the dactylus is bent under that of the immobile finger. The smaller or left chelipede extends to about the middle of the hand of the larger chelipede, and in some cases even to the articulation of the dactylus.

The ambulatory legs are unarmed, though faintly pubescent, especially the terminal portions of the dactyli. The dactyli are not quite twice the length of the propodi.

The gills are similar to those of *P. andersoni*, but the lamellae are narrower. The eggs are moderately large, and the oviducal opening of the female is, as usual in the genus, present only on the left side.

The largest specimen is a female with ova, which measures as follows:—

Length of body*	...	...	...	... 16 mm.
„ „ carapace	...	...	...	... 5·5 „
„ „ right chelipede	...	...	...	... 10·5 „
„ „ first right leg	...	...	...	... 16 „

The chief feature of the species is its small size. Although the fact that some of the females carry ova is not in itself sufficient to indicate that they have attained their maximum size, yet I think it may be safely assumed that by this time they have developed all the leading specific characters. In some Pagurids, notably the common European *Eupagurus bernhardus*, (Linn.) considerable differences may be observed in the size of egg-bearing females.

Genus Sympagurus, S. I. Smith.

This genus according to A. Milne-Edwards and Bouvier, is distinguished from *Parapagurus* solely by the arrangement of the gills, which are biserial and not quadriserial, and in the opinion of these observers the two genera ought probably to be united. A connecting link occurs in the *S. nudus*, A. Milne-Edwards, taken by the "Hirondelle," in which at the base of each branchial lamella there is an external rudimentary lamella, and if the latter were somewhat larger the gill would resemble that of a *Parapagurus*. The evidence furnished by this species, tends at

* Owing to the species inhabiting a *Dentalium* shell, the body—unlike that of most Pagurids—is fully extended.

least to show that characters derived from the gills are of somewhat doubtful value in the classification of the Paguridae. On the other hand the species of *Sympagurus* do not appear as a rule to reach the great depths at which species of *Parapagurus* are found, and in some of the species, including the one about to be described, the eye-stalks, unlike those of the last named genus, exhibit a certain amount of dilatation. Moreover the gill-branches of *Parapagurus* are more or less filamentous, while those of *Sympagurus* are lamellate. For the present the two genera may therefore I think be kept separate.

14. **Sympagurus monstrosus*, (Alcock).

(?) *Parapagurus monstrosus*, Alcock, Ann. Mag. Nat. Hist. (6) xiii. 1894, p. 243.

Station 151, off the coast of Ceylon, depth 142 to 400 fathoms. Four specimens.

Station 162, off the Madras Coast, depth 145 to 250 fathoms. A large number of specimens, the majority inhabiting *Rostellaria* shells, some of which have an investing *Epizoanthus*, others an *Actinia*.

The anterior portion of the carapace is slightly convex, with a curved line on either side terminating behind the basal joint of the antennal peduncle. The three frontal projections are slight, but the median one exhibits a faint dorsal carina. The eye-stalks are stout, with the upper surface slightly pubescent, and the corneae considerably dilated. The ophthalmic scales are broad basally, but acute and spinulous at the apex. The antennal peduncle only slightly exceeds the eye-stalk; the acicle is moderately curved, with its inner margin dentate; the external prolongation of the second peduncular joint is spinulous. The antennular peduncle exceeds the eye-stalk by slightly more than the length of the terminal peduncular joint.

The chelipedes are slightly pubescent, and yet glabrous, with the terminal joints of the larger one regularly dentate. The right chelipede has the merus provided with a serrated lobe on its lower distal margin, while the upper margin is more faintly serrated, and the outer surface is obscurely tuberculate. The carpus is considerably swollen below, and all its projecting margins are dentate, the denticles being best marked on the outer margin, and on the lower and inner margin. The upper surface of the hand is regularly arched or convex from end to end, the curvature showing clearly on the thin outer margin; both inner and outer margins are regularly dentate, the thick inner margin showing a double line of denticles. The upper surface of the hand is smooth and glabrous, only a few minute granules being present, but it is at the same time more or less pubescent. The fingers are strongly

* Ill. Zool. Investigator, Crustacea, pl. xxxii. fig. 4 *(in preparation)*.

incurved, and the upper margin of the dactylus is strongly dentate. The left chelipede is slender and almost smooth, with the carpus considerably longer than the hand, and the fingers about equal in length to the palm.

The ambulatory legs are practically smooth, only a few marginal hairs being present. The anterior margin of the meri is faintly tubercular, and in some specimens there is a denticle at the anterior distal end of the carpus. The dactyli are about one and a half times the length of the propodi.

The gills are biserial, without any trace of outer lamellae; the inner lamellae are long and somewhat narrow, resembling those of *S. pilimanus*, A. Milne-Edwards, as figured by Milne-Edwards and Bouvier, in their Report on the "Blake" Paguridae.

An adult male gives the following measurements:—

Length of body	...	17 mm.
„ „ right chelipede	...	20 „
„ „ left chelipede	...	15 „
„ „ third right leg	...	27 „
„ „ eye-stalk	...	2·5 „

This species is closely allied to *Parapagurus gracilis*, Henderson (which is probably a *Sympagurus*), taken by the "Challenger" off Pernambuco, at a depth of 350 fathoms. It agrees with the latter in the character of its eye-stalks, but the dilatation of the corneae is somewhat greater in *S. monstrosus*. It differs, however, in the more regular denticulation of its hand, while this part is also considerably broader in the "Challenger" species. It also bears considerable resemblance to *S. arcuatus*, A. Milne-Edwards and Bouvier, from the West Indies, in which however, the larger hand is more distinctly granulated on the upper surface, and the carpus presents a row of denticles on its upper surface, bordering the articulation of the hand. Subsequent investigation may possibly show that all three species are identical.

Undetermined species.

15. *Clibanarius* sp.

Great Sober Island, Trincomallee Harbour. Four small specimens.

The largest example measures only 20 mm. in total length, and all are obviously very young. They probably belong to some common litoral species.

16. *Eupagurus* sp.

Station 151, off the coast of Ceylon, depth 142 to 400 fathoms

A female apparently adult, and a very young individual in shells (*Murex ?*), overgrown by an *Epizoanthus*.

The larger specimen has lost its abdomen, but the carapace measures 10 mm. in length.

Both the median and lateral frontal projections are prominent and subacute, the median being somewhat better marked than the lateral. The eye-stalks are rather short, while the narrow and acute ophthalmic scales are separated by a somewhat narrow interval. The external prolongation of the second joint of the antennal peduncle, and the antennal acicle, are both well developed; the antennal flagellum is not twice the length of the carapace, and is fringed with long hairs.

The chelipedes and ambulatory legs have a dense covering of long yellowish hairs on their upper surface. The right chelipede is stouter but only slightly longer than the left; its fingers move in a horizontal plane, and have horny tips. The carpal and propodal joints show a few acute denticles scattered among the hairs on the upper surface. The dactyli of the ambulatory legs are provided with yellow horny apices.

I hesitate to describe this species under a new name as the single adult specimen is very incomplete, and it is impossible to ascertain whether sexual appendages were present or not. If the species is an *Eupagurus*, as is seems to be, it is probably new, and is chiefly characterised by the form of its chelipedes, and the strongly marked pubescence.

17. Glaucothoë.

Station 150, off the North Maldive Atoll, depth 719 fathoms. A single example measuring about 20 mm. in length.

The right chelipede is granulated and considerably larger than the left. The abdomen is slighly folded on itself perhaps accidentally, but is not spirally twisted. The species agrees with *G. peronii*, Milne-Edwards (Ann. Sci. Nat, t. XIX. p. 334, pl. VIII. 1830), in its unequal chelipedes, whereas in *G. rostrata*, Miers, and *G. carinata*, Henderson, they are equal. It is distinguished from Milne-Edwards' species by the granulation of the larger chelipede, the presence of a rather broad median frontal projection, and by the greater length of the ambulatory (or possibly swimming) dactyli, which in Milne-Edwards' figure are represented as about equal in length to the propodi, while in our example they are fully one and a half times as long. Milne-Edwards' example was also considerably smaller.

Glaucothoë has been regarded both as an adult, and as an imma-

ture form, but the balance seems in favour of the latter view. No trace of sexual openings can be made out in the "Investigator" specimen, nor do they appear to have been described in any of the previous records. It is apparently very rare, and it is difficult even to surmise what Pagurid it can be the normal larva of, so it may possibly be an arrested larval form. If Miers' theory as to the nature of *Grimothea gregaria*, Leach, be correct, *viz.*, that this Galatheid is merely a pelagic larval form of *Munida subrugosa* (White), we would have a similar parallel, but there is no evidence to show that *Glaucothoë* leads a pelagic life.

Noviciæ Indicæ XIII. *Further Notes on Indian* Convolvulaceæ; *with descriptions of three additional species.—By* D. Prain.

[Recd. 24th June, Read 1st July.]

Since the presentation of the notes on *Convolvulaceæ* published as *Noviciæ Indicæ* VIII, in August 1894, three more species have been added to the Indian Flora. Descriptions of these are now given for the convenience of field-botanists and the present opportunity is taken of adding notes regarding several species already dealt with.

1. ERYCIBE Roxb.

10. Erycibe coriacea *Wall.*

While at work in the *Prodromus* Herbarium of M. Casimir de Candolle at Geneva, the writer was able to compare examples of *E. fragrans* (agreeing with *Wall. Cat.* n. 1336) with the apparently unique specimen of *E. coriacea* Wall. (*Cat.* n. 1337) which has not been lost but is safely preserved in the cover in which M. Choisy had placed it. Its flowers are exactly identical with those of *Wall. Cat.* n. 1336 nor do its leaves differ sufficiently, in the writer's opinion, to admit of the two plants being treated even as distinct varieties.

15. Erycibe festiva *Prain, Nov. Ind.* viii. 76.

In the description, for "cymes many-fld." read "cymes 7–12-fld."

17. Erycibe strigosa *Prain*; branchlets round densely covered with a black adpressed tomentum, leaves rather long-petioled thinly coriaceous glabrous above densely covered with a black adpressed tomentum beneath, elliptic, base cuneate apex rather long-acuminate, lateral nerves visible beneath not above, cymes few-fld. in long narrow axillary panicles with densely rusty tomentose rachis, peduncles and pedicels.

Malay Peninsula: Perak, at Tnaipeng 500–800 feet elev., *Kunstler* n. 8461!